A UNIQUE FORM OF *VALONIOPSIS PACHYNEMA* (CHLOROPHYTA) FROM FRENCH POLYNESIA

Isabella A. ABBOTT*

ABSTRACT. – Unusual round, ball-like forms of *Valoniopsis pachynema* (Martens) Børgesen were found in the quiet waters of a lagoon near Maeva, Huahine Island, French Polynesia. In shape they resemble *Codium mamillosum* Harvey, in the Pacific subtropics, and several species of *Cladophora*, especially the thalli of *Cladophora sauteri* (Nees ex Kützing) Kützing of several lakes on the Island of Hokkaido (Japan) and in some European lakes.

RÉSUMÉ. – *Valoniopsis pachynema* (Martens) Børgesen a été trouvé dans les eaux calmes de la lagune de Maeva (île de Huahine, Polynésie Française) sous une forme inhabituelle, ronde, semblable à des pelotes. Sous cette forme il ressemble au *Codium mamillosum* Harvey des eaux subtropicales du Pacifique, et à diverses espèces de *Cladophora*, en particulier aux thalles de *Cladophora sauteri* (Nees ex Kützing) Kützing de plusieurs lacs de l'île d'Hokkaido au Japon, et aussi de quelques lacs européens.

KEY WORDS : algal balls, green algae, French Polynesia.

INTRODUCTION

Posidonia balls or **marine balls**, composed of *Posidonia oceanica* (L.) Delile, have been reported on Mediterranean shores since ancient times and similar balls, produced principally from leaves of *P. australis* J.D. Hooker are common on southern Australian shores (WOMERSLEY, 1984, pl. 16, Figs. 2, 3). Less recognized are the ball-like forms produced by several green algae, and a few brown and red algae as well.

Ball-like morphologies in the green algae occur in a number of unrelated habitats such as at 90-106 m depth (AGEGIAN and ABBOTT, 1985) on eroded coral in the subtropics of Hawaii, to 42 m depth in South Australia (WOMERSLEY, 1984), in marine and freshwater habitats of Europe (HOEK, 1963) and South Australia (WOMERSLEY, 1984) and in certain of the freshwater lakes (KUROGI, 1976) on Japan's most northern Island, Hokkaido. This morphology is the natural one for *Codium mamillosum* Harvey (Fig. 1) and *C. pomoides* J. Agardh (see EGEROD, 1952; WOMERSLEY, 1984) where the individual

* Department of Botany, University of Hawaii, Honolulu, Hawaii - 96822 U.S.A.

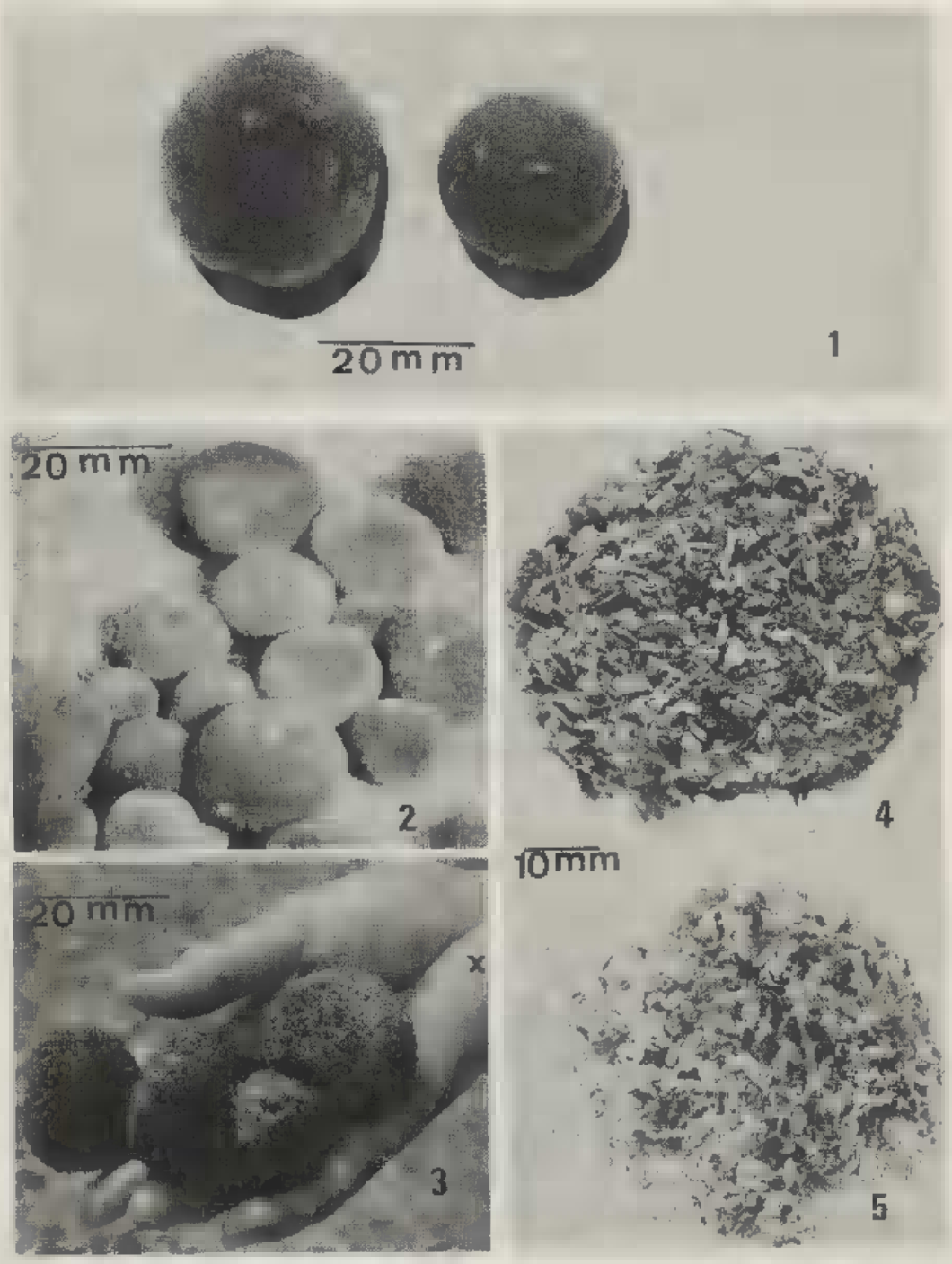

Fig. 1 : *Codium mamillosum* **Harvey, 117 m depth from Penguin Bank, Hawaiian Islands.** Courtesy of J.N. Norris. – Fig. 2 : *Cladophora sauteri* (Nees) Kützing from Lake Akan, Hokkaido, Japan. Courtesy of M. Kurogi. – Fig. 3 : *Valoniopsis pachynema* Børgesen, fresh material as collected at Huahine Island, French Polynesia. Courtesy of D.P. Abbott. – Fig. 4 : *Valoniopsis pachynema*, air-dried specimen which was dark green when drying started. Courtesy of W.H. Magruder. – Fig. 5 : *Valoniopsis pachynema*, air-dried specimen which was light green and naturally bleached when drying started. Courtesy of W.H. Magruder.

utricles come to the surface by shortening or lengthening resulting in a more or less globular thallus. In other marine species such as *Cladophora aegagropiloidea* Hoek and Womersley (1984), and *Wittrockiella salina* Chapman, which also has a form of free-floating, hollow balls (HOEK et al., 1984; WOMERSLEY, 1984), the dried specimens (WOMERSLEY, 1984, fig. 60b, 69c, 71e) clearly show that the branches are also of different lengths in composing the globular shape. Perhaps better known than these species is the «marimo» or *Cladophora sauteri* (Nees ex Kützing) Kützing (Fig. 2), known in Japan as a national natural treasure (KUROGI, 1976) and one of the few algae that is on a postage stamp (Japan Postal Issue). This latter form (a synonym of *Cladophora aegagropila* (L.) Rabenh., according to HOEK, 1963) is widely spread in European lakes.

The usual form of *Valoniopsis pachynema* (Martens) Børgesen is described (BØRGESEN, 1934; DAWSON, 1944) as a decumbent, cushion-like thallus with spreading filaments. The ball-like form (Fig. 3, 5) was found on Huahine Island, French Polynesia (Fig. 6) as drifting, stranded, and semi-attached balls. Several, particularly those stranded, showed a strong similarity in habit to *Cladophora sauteri* (KUROGI, 1976, Fig. 1) when it, too, is stranded. The common European lake species, *Cladophora aegagropila* (L.) Rabenhorst is the non-ball-like form of the same species (see HOEK, 1963).

DESCRIPTION

Several hundred thalli were seen from which eight specimens were chosen (Figs. 3-5). The globular thalli were dark green, between 3.3 and 6.2 cm diam., the upper edges (Fig. 5) of some of the stranded ones bleached by the sun. The upright branches arising from arcuate to decumbent axes were between 0.75 to 1 cm tall, the penultimate cells (n = 20) with a range of 1-2 mm wide and a mean measurement of 1.8 mm, the ultimate cells (n = 20) with a mean of 0.78 mm (range = 0.5 to 1.2 mm). In water about 0.3 m depth, the thalli appeared to be semi attached to small pebbles in sandy mud and were the most green of all the plants. The thalli did not show any dorsiventral orientation, and only a few filaments were extended from one surface (taken, therefore, to be the basal portion of the thallus) that formed a loose hapteroid attachment.

Abbott #17645, collected near Marae Vaiotaha, Lac Fauna Nui, near Maeva, Huahine Nui, French Polynesia (near 157°E. long.; 18°S lat.) by D.P. Abbott and I.A. Abott, June 4, 1985.

DISCUSSION

Valoniopsis is distinguished from *Valonia* by BØRGESEN (1934) on the method of formation of new branches or laterals, initiated by earlike protrusions at the terminal portion of erect filaments, and not from exogenous protrusions of cytoplasts in the manner of segregative division that BØRGESEN claimed for the Siphonocladales among which *Valonia* is placed. Though lacking reproduc-

tion of any kind. BØRGESEN placed *Valoniopsis* in the Anadyomenaceae on account of the basipetal branching «reminiscent of the ramification found in *Anadyomene*, *Rhipidiphyllon* and *Willeella*» and because the branches that can grow out in all directions. The Anadyomenaceae (Cladophorales) have subsequently been reorganized (HOEK, 1984) to exclude *Willeella*, now placed in the Cladophoraceae (WOMERSLEY, 1984). Moreover, PAPENFUSS and EGEROD (1957) referred *Valoniopsis* to the Valoniaceae since a small lenticular cell, cut off along the lateral wall of the parent filament produces an exogenous protuberance which eventually gives rise to a branch with a basal septum, as in *Valonia*. Having thus diminished the differences between *Valoniopsis* and *Valonia*, PAPENFUSS and EGEROD did not further characterize *V. pachynema*. HOEK (1984), however, places *Valonia* in the Cladophorales, along with all other members of the Siphonocladales.

Confined to the subtropics and tropics, the species has been reported from the Pacific in the Gulf of California (DAWSON, 1944, with a wider distribution range by NORRIS, 1975); Ryukyu Islands and Taiwan (OKAMURA, 1909); South China (TSENG, 1933), Viet Nam (PHAM-HOANG, 1969), Indonesia (WEBER VAN BOSSE, 1913); in the western Atlantic from Bermuda (COLLINS & HERVEY, 1917), Hispaniola (TAYLOR, 1960); the Indian Ocean from Kenya (ISAAC, 1957), Ceylon, India (WEBER VAN BOSSE, 1913), South Africa (PAPENFUSS & EGEROD, 1957). Only one of the species is known, *V. hancockii* Dawson (1944) from Isla Angel de la Guarda, Gulf of California, which is distinguished by constrictions at the junction of ultimate and penultimate segments. *Valoniopsis pachynema* from Huanine also shows constrictions in such places, but cell diameters are 2-3 times those of *V. hancockii*, which has never been collected since its type collection. In examining specimens in the B.P. Bishop Museum, Honolulu, of *Valoniopsis* and *Valonia*, it appears that persons such as W.A. SETCHELL, W.R. TAYLOR, W.J. GILBERT, and E.Y. DAWSON all had a general notion of what constituted *Valoniopsis*, but that when their specimens are compared with those known as *Valonia aegagropila* C. Agardh as interpreted by EGEROD (1952), the boundaries are not at all clear, as pointed out by EGEROD (1952) for species of *Valonia* and as implied by PAPENFUSS and EGEROD (1957) for *Valoniopsis*. What is identified here as *Valoniopsis pachynema* may become a species of *Valonia* as the pulvinate, matted species of the latter genus become better understood. In any case, at this time there are no ball-like forms of either genus previously described from the tropics.

The occurrence of an aegagropilous form of *Valoniopsis*, representing a new record of the species in French Polynesia (however, PAYRI and MEINESZ, 1985, have listed *Valoniopsis* sp. from Moorea), is not as surprising as is the location from which it was collected. This lagoon habitat is several km from the open coast, where the non-ball-like form of this species would occur in other localities. Two hypotheses have been advanced on the origin of «lake balls» of *Cladophora aegagropila*. The ball-form is the result of : 1) interaction between the gentle rolling motion on shallow lake bottoms and growth properties inherent to the species (HOEK, 1963), or 2) purely the mechanical result of the

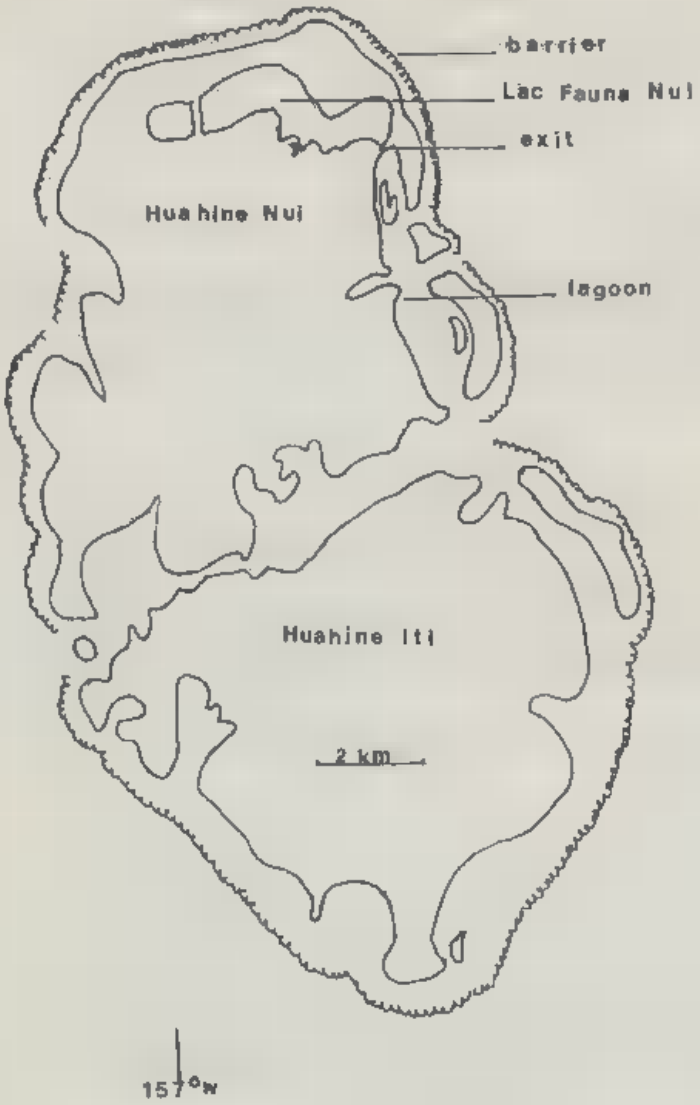

Fig. 6 : Map of Huahine, showing Huahine Nui and Huahine Iti. Lac Fauna Nui, where the *Valoniopsis* balls were collected (x), is an internal lagoon with only one exit to the larger lagoon that is adjacent to the barrier reef.

rolling motion of waves on shallow, sandy lake shores (WESENBERG-LUND, 1903; HOEK, 1963). The first hypothesis is favored vy HOEK (1963) who suggests that the slight rolling motion of the water helps to regularly expose all sides of the ball to light. I speculate that the thalli of the material under study are torn and cast adrift from their high-energy, open coast habitat, and brought into the calm situation of the lagoon (Fig. 6, map) in which they were found and where they continue to grow. Should this be the case, then the second hypothesis would explain the occurrence of the balls 3-4 km from their suppo-

sed habitat. It would be interesting to experiment on the factors responsible for the development of the ball-like thalli. For example, by simulating the action of waves and eddies, CANNON (1979), using a washing machine, demonstrated how *Posidonia* balls could be formed.

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